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PROVISIONAL SPECIFICATION

200390 filed 20th June 2003

Invention Title : Easy Open Package

Applicant: Plantic Technologies Ltd
[ACN 097 524 975]]

Inventor:

The invention is described in the following statement:

Easy Open Package

This invention relates to an easy open package for items that are used when wet, in particular tooth brushes.

5 **Background to the invention**

Most manufactured products are presented for sale in packages. The packaging material usually of paper paperboard and/or plastics needs to be printable and also to protect the articles. For personal hygiene products the articles usually are sealed to ensure the hygiene standards for the product. Consumers usually like to

- 10 be able to see what they are purchasing so that it is common for at least part of the packaging material to be transparent.

Tooth brushes are commonly enclosed in a blister pack of transparent thermoformed plastic material enclosing the brush with a paper or paperboard panel at the back. Such packages can be difficult to open as the materials used do

- 15 not tear easily and it is often necessary to use scissors to open the package. The package then has to be disposed of and packaging of this sort adds to the environmental burden of waste disposal because the materials are not readily biodegradable.

- Other articles are packaged in a similar fashion and present similar difficulties in
20 opening and the disposing of the packaging material.

It is an object of this invention to provide an easily opened package that is also easily disposed of in an environmentally responsible fashion.

Brief description of the invention

- To this end the present invention provides a product and package combination in
25 which a significant portion of the package is sufficiently water soluble that the package can be disintegrated by exposure to water.

This package combination may be applied to any product that is usually opened in the vicinity of water such as cleaning utensils, garden utensils and some food stuffs such as vegetables.

- 30 A tooth brush enclosed in a water soluble packaging material may be opened by placing it under water or a running tap or faucet so that the packaging material is disintegrated exposing the tooth brush ready for use.

The packaging material is preferably composed of a thermoformed transparent water soluble polymer composition preferably alone or with a paper or other material for the rear of the package, that is easily disintegrated by contact with water and biodegrades in waste water systems.

5 The advantage of this invention is that the product is easily released from its packaging and at the same time is instantly disposed of as a waste water effluent. In the case of a tooth brush the consumer usually opens the package in front of a basin and would turn on the tap or faucet to use the brush. Thus the combination provides two significant benefits.

10 Not all biodegradable materials are water soluble so that prior art packages made from biodegradable materials could not be opened by the action of water and would have to be disposed of as solid house hold waste.

The preferred water soluble polymers are those based on starch or modified starch alone or blended with other water soluble synthetic polymers such as water soluble

15 grades of polyvinyl alcohol.

A preferred biodegradable polymer has the composition

a) from 8 to 90% by weight of a modified starch preferably starch modified to include an hydroxyalkyl C₂₋₆ group or modified by reaction with an anhydride of a dicarboxylic acid

20 b) from 0 to 80% of starch

c) from 0.5 to 11% by weight of a water soluble polymer selected from polyvinylacetate, polyvinyl alcohol and copolymers of ethylene and vinylalcohol which have a melting point compatible with the molten state of the starch components

25 d) from 0 to 20% by weight of a polyol plasticiser

e) from 0.1 to 1.5 % by weight of a C₁₂₋₂₂ fatty acid or salt and

f) from 0 to 12 % by weight of added water.

30 The composition defined include formulations suitable for forming films or thermoforming rigid products such as transparent blister packs. The extruded sheet can be thermoformed into blister packs for use as biodegradable packaging. Usually the need to vent the extruder to remove water prior to the product exiting the extrusion die is not needed with these formulations.

Other processing methods may be used including injection moulding, extruded shapes including tubes, cast films for wraps and thermoformed sheet.

The modified starch contributes structural benefits to the resulting material. A preferred component is hydroxypropylated amylose. Other substituents can be

- 5 hydroxyethyl or hydroxybutyl to form hydroxyether substitutions, or anhydrides such as maleic phthalic or octenyl succinic anhydride can be used to produce ester derivatives. The degree of substitution[the average number of hydroxyl groups in a unit that are substituted] is preferably 0.05 to 2. The preferred starch is a high amylose maize starch. A preferred component is a hydroxypropylated high amylose starch A939 marketed by Penford Australia.

10 The other starch component is any commercially available starch. Dependent on the mechanical and optical properties required, a preferred concentration range for starch is 50 to 70.6%. This may be derived from wheat, maize, potato, rice, oat, arrowroot, and pea sources. Generally the water content is about 8 to 15 %.

- 15 The polymer component c) of the composition is preferably compatible with starch, water soluble, biodegradable and has a low melting point compatible with the processing temperatures for starch. Polyvinyl alcohol is the preferred polymer but polymers of ethylene-vinyl alcohol, ethylene vinyl acetate or blends with polyvinyl alcohol may be used. A preferred concentration range for sheet material is

20 7 to 9%.

The preferred plasticiser is glycerol although ethylene glycol and diethylene glycol are also suitable as is sorbitol. Cost and for some products food contact, are important considerations in choosing the appropriate plasticizer. For low humidity environments it has been found that lower plasticizer content improves the

- 25 toughness and long term resilience of the material. This is partly due to the properties of the starch ether component and the fact that at low humidity plasticizers such as glycerol tend to remove water from the starch polymer and make it more brittle. It is possible to process the formulation with no plasticizer and the rigid polymer formed is flexible and has good impact resistance at low

30 humidity. When the plasticiser content is low additional water is added to improve processing. Thus the plasticizer content is preferably 0 to 12% and the water content is 12 to 0%. For film processing the plasticizer content is preferably higher than for rigid sheet products. Higher concentrations of plasticiser improve flexibility

and for flexible packaging films or other thin films the preferred plasticiser content is 10 to 16%.

The fatty acid or fatty acid salt component is preferably present in concentrations of 0.6 to 1%. Stearic acid is the preferred component. Sodium and potassium salts

- 5 of stearic acid can also be used. Again cost can be a factor in the choice of this component but lauric, myristic, palmitic, linoleic and behenic acids are all suitable. It is found that the acid tends to accumulate near to the surface of the composition as it is extruded.

10 Detailed description of the invention

A preferred embodiment of the invention will be described with reference to the drawings in which

Figure 1 is a plan view of a typical tooth brush package;
and Figure 2 is a side view of the package without the tooth brush.

- 15 The package as shown consists of a tooth brush 2 sealed within a transparent blister 3 which is sealed against a paper backing 4 to completely enclose the tooth brush.

The blister material is formed from a thermo formable starch polymer composition of the formula

A939 %	PVOH %	Stearic acid %	Water %	Glycerol %
81.5	8	0.5	10	0

20

An alternative and cheaper formulation is to replace 50% of the A939 with wheat starch.

- Processing conditions depend on the formulations and the desired properties of the product to be produced. The materials need to be heated above 130 °C in the 25 extruder to fully gelatinise the starches. The die temperature needs to be controlled below 110 °C to avoid foaming.

The preferred method of carrying out this invention involves mixing the starch, modified starch, vinylalcohol polymer lubricant and fatty acid components into a free flowing powder. The premixing can be carried out in any conventional mixer.

- 30 The powder is then introduced into a screw extruder and subjected to an elevated

temperature by the shearing action of the screw and the application of external heat to the barrel. The temperature equilibrates to an adiabatic profile ranging 40°C to 150 °C. Any liquid components including additional water are introduced by liquid injection or in the premix. The melt that is formed is then propelled toward

- 5 the die where the temperature is reduced to a value in the range of 65 °C to 105°C. A typical extrusion for rigid products in a single stage process has the following parameters:

Temperature profile °C: 60, 70, 90, 110, 130, 145, 130, 120, 110

Screw Speed: 120 rpm

- 10 In a two-stage process, where compounding and sheet forming are separated, the compounding processing conditions are typically:

Temperature profile °C: 50, 50, 65, 130, 130, 90, 65

Screw Speed: 150 rpm

And sheet forming occurs in a single screw extruder with

- 15 Temperature profile °C: 50, 90, 130, 115

Screw speed: 150 rpm

Sheet ranging from 10micron to 800 micron can be extruded on a cast sheet line.

Cooling and drying of the sheet in between the various rolls of the haul off line, is required to achieve the final moisture content of the sheet prior to wind-up, such as

- 20 to avoid blocking and shrinkage on the wind-up roll. If the film is formed by the blown tube method some form of drying is also used. Talc may also be entrained in the air stream to reduce blocking of the film.

The films and thermoformed plastics of this invention are transparent and printable and are ideally suited as packaging items that need to be seen within the package.

- 25 The preferred compositions used in this invention are cold sealable and heat sealable. If transparency is not desired the package can be made non transparent. The preferred compositions are not sticky and have no offensive odour on dissolving in water.

Those skilled in the art will realize that this invention may be implemented in a 30 variety of ways without departing from the essential teachings of the invention.

CLAIMS

1. A product and package combination in which a significant portion of the package is sufficiently water soluble that the package can be disintegrated by exposure to water.
2. A tooth brush enclosed in a blister package made from a transparent water soluble thermoformable polymer composition.
3. A package as claimed in claim 1 or 2 in which the water soluble packaging material is made from
 - a) from 8 to 90% by weight of a starch modified to include an hydroxyalkyl C₂₋₆ group or modified by reaction with an anhydride of a dicarboxylic acid
 - b) from 0 to 80% of starch
 - c) from 0.5 to 11% by weight of a water soluble polymer selected from polyvinylacetate, polyvinyl alcohol and copolymers of ethylene and vinylalcohol which have a melting point compatible with the molten state of the starch components
 - d) from 0 to 20% by weight of a polyol plasticizer
 - e) from 0.1 to 1.5 % by weight of a C₁₂₋₂₂ fatty acid or salt and
 - f) from 0 to 12 % by weight of added water.

ABSTRACT

A tooth brush enclosed in a water soluble packaging material can be opened by placing it under a running tap or faucet so that the packaging material is disintegrated and washed away exposing the tooth brush ready for use, without
5 sticky or odorous residue. The packaging material is composed of a thermoformable transparent water soluble starch based polymer composition that is easily disintegrated by direct contact with water, and that biodegrades in waste water.



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